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RESEARCH NOTE RM-165

ROCKY MOUNTAIN FOREST AND RANGE EXPERIMENT STATION

Fourwing Saltbush Survival after Inundation[1]

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Four-week-old fourwing saltbush transplants are subject to high mortality if planted in areas likely to be inundated for longer than 30 hours.
(KEY WORDS: Atriplex canescens, fourwing saltbush, flood control, watershed management, soil-binding plants)

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Chamiza or fourwing saltbush (Atriplex canescens (Pursh) Nutt.) is considered an excellent forage plant for domestic livestock. Its virtues for reseeding rangelands have been known for a long time.[3] Recently, this plant has been used in watershed restoration work on alluvial flood plains on the Rio Puerco drainage in New Mexico.[4] Fourwing saltbush is also being planted behind flood detention structures by the Bureau of Land Management to trap sediment above a dam's main pool, thereby prolonging the useful life of the structure. Establishment of plant cover behind these structures will also enhance wildlife values. If plantings are to be successful, however, they must be made where high water levels will not be maintained for long periods of time. This study was designed to find how long fourwing saltbush plants could withstand inundation and still survive.

Methods

Ten 4-week-old fourwing saltbush plants, each in a 3-inch plant band, were placed in each of 22 plastic buckets 13 inches deep. Soil was packed in the spaces between the bands. Tap water was poured into the buckets to the brim, thus covering the plants with about 10 inches of water. This water was "aged" several days and air pumped through it for 12 hours prior to its use to remove any chlorine. The filled buckets were placed outdoors where they would be subjected to diurnal temperature fluctuations.

A thermograph in a standard U.S. Weather Bureau shelter was maintained on the site to monitor air temperatures.

At 2-hour intervals, from 10 a.m. through 4 p.m. for 3 days, the water was syphoned off one bucket and the bucket was brought into the greenhouse where 80° F. daytime and 65° F. nighttime temperatures were maintained. Survival dropped rapidly somewhere between the 30th and 48th hour of submergence. Since this occurred overnight on the first run, a similar test was made for 2-hour intervals between the 32nd and 48th hour. All conditions in this second run were similar to the first run, so the data were analyzed together.

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[1] *Study conducted in cooperation with the Bureau of Land Management, U. S. Department of the Interior, Albuquerque, New Mexico.*

[2] *Principal Hydrologist, located at Albuquerque, in cooperation with the University of New Mexico; central headquarters maintained at Fort Collins, in cooperation with Colorado State University.*

[3] *Springfield, H. W., and Housley, R. M., Jr. Chamiza for reseeding New Mexico rangelands. U.S. Dep. Agr., Forest Serv., Southwest. Forest and Range Exp. Sta. Res. Note 122, 5 p., illus. 1952. Tucson, Ariz. [Consolidated in 1953 with Rocky Mt. Forest and Range Exp. Sta., Fort Collins, Colo.]*

[4] *Aldon, Earl F. Fourwing saltbush can be field planted successfully. 1970. (In preparation for publication, Rocky Mt. Forest and Range Exp. Sta., U. S. Dep. Agr., Forest Serv., Fort Collins, Colo.)*

Within 10 minutes after water was removed from the buckets, some plants were cut into sections and treated with 2,3,5-triphenyl-tetrazolium chloride (TTC).[5]

After 5 days in the greenhouse, the dead plants in each bucket were counted and percent mortality computed. A probit analysis of mortality percentages over time was made.[6] These data were then analyzed by regression with mortality as the dependent variable.

Air and water temperatures were measured at the time the plants were removed from the water, and the data were related by regression analyses.

Results

Four-week-old fourwing saltbush transplants tolerated 29 hours of submergence before 50 percent of the plants died. After 40 hours under water, almost 70 percent of the plants were dead.

[5]*Parker, J. Some applications and limitations of tetrazolium chloride. Science 118: 77-79. 1953.*

[6]*Finney, D. J. Statistical method in biological assay. Ed. 2, 668 p., illus. New York: Hafner Publ. Co. 1964.*

The relationship between percent mortality and hours submerged was calculated by means of probit and logarithmic transformations, respectively [6] (fig. 1). The scatter of data points is in part due to small numbers of plants (10 per "dose").

Air and water temperatures were highly correlated, r = 0.98. Water temperatures ranged from a low of 54° F. to a high of 98° F. High water temperatures were maintained for only a few hours in the afternoons as determined from the air temperature data and were not lethal to the plants. These water temperatures are similar to those encountered under field conditions.

Plant tissue that was under water for any length of time did not stain red with TTC as detected visually. Plants were without oxygen soon after submergence, and the TTC test for viable tissue cannot be used under this condition. Many submerged plants did recover and continue to grow in the greenhouse, however.

When field planting fourwing saltbush transplants, locate plants where they will not be subjected to more than about 30 hours of flood water submergence. Longer periods under water will result in high mortality.

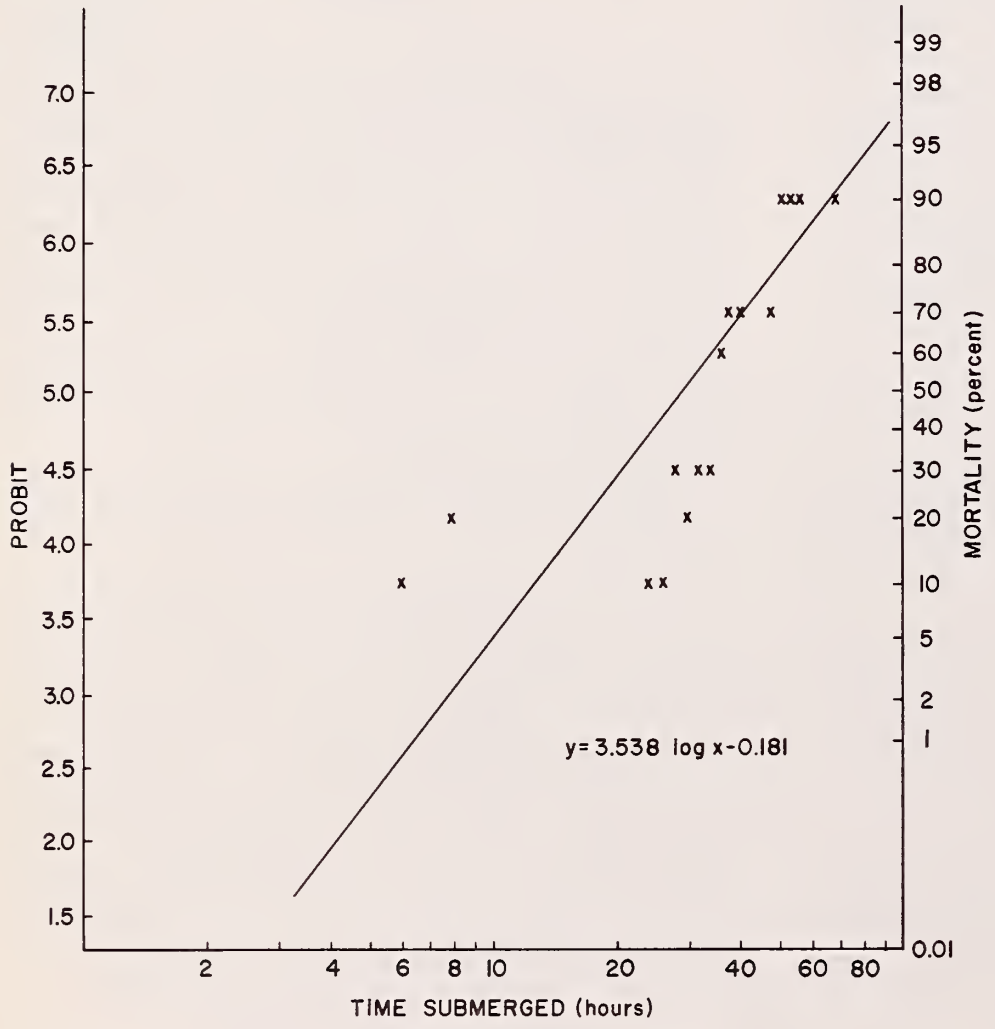

Figure 1.--Relationship between hours submerged and the percent mortality of young fourwing saltbush plants.

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